ORIGINAL ARTICLE

Comparative study of functional and radiological results of proximal femoral nail and dynamic hip screw in treatment of intertrochnateric fracture

Praveen Garg[1], Suryansh Nema[1], Simran Gupta[2], Madan Mohan Nagar[1]

[1]Department of Orthopedics, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India, [2]Department of Radiodiagnosis, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India

Corresponding Author:
Praveen Garg, Department of Orthopedics, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India.
E-mail: drpraveengarg.ortho@gmail.com

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Background: One of the most frequent fractures of the hip is an intertrochanteric fracture, which most often occurs in older people with osteoporotic bones and is typically brought on by low-energy injuries, such as easy falls. To address intertrochanteric fractures of type 31A2 type, this research compared the functional and radiological outcomes of proximal femoral nail (PFN) with dynamic hip screw (DHS).
Materials and Methods: From November 2020 to November 2022, prospective randomized and comparative study was conducted on the 100 patients of type 31-A2 intertrochanteric fractures of hip who were operated using PFN or DHS. Intraoperative complications were noted. Functional outcome was assessed using Harris hip score (HHS) and radiological findings were compared at 6, 12, and 24 months postoperatively.
Results: In our research, out of 100 patients, 48 patients received DHS management, and 52 patients received PFN management. The subjects ranged in age from 45 to 75 years. In our series, we discovered that patients with DHS needed more time for mobilization and had longer surgery times (110 min), whereas patients with PFN had quicker surgery times (94 min) and were permitted to move around more quickly. In addition, the DHS group has more problems than the PFN group does, including DVT, lag screw cutting, shortening, and surface infection. The patients who received PFN began ambulating sooner because both in the early and late postpartum periods, their HHS was improved.
Conclusion: When treating type 31A2 intertrochanteric fractures, PFN outperforms DHS in terms of less blood loss, shorter surgical times, quicker weight-bearing and movement, shorter hospital stays, lower risks of infection, and fewer complications.

KEY WORDS: PFN, DHS, Intratrochanteric fracture

INTRODUCTION

Intertrochanteric fractures are those in which the greater and lesser trochanters of the upper femoral extremity are involved and may spread into the upper femoral shaft.[1]

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Intertrochanteric fractures frequently occur in older individuals with osteoporosis.[2] Due to increased longevity and an increase in the frequency of transportation collisions, the rate is projected to double by 2040.[3] Both surgical and non-surgical approaches can be used to address intertrochanteric fractures. Early in the 19th century, non-operative therapy was preferred because sufficient surgical skill had not yet developed to stabilize the fracture.[4] The cautious strategy frequently leads to complications. Proximal femoral nail (PFN) or the dynamic hip screw (DHS) are examples of surgical techniques. While PFNs are frequently used devices in intramedullary fixation, DHS is frequently used in extramedullary fixation.[5]

In DHS with a fixed-angle locking side plate, the chance of implant failure is reduced, which is advantageous in unstable fractures caused by osteoporosis.[6] PFN shortens the distance between the hip joint and implant, resulting in a design that is more biomechanically secure.[1,7,8] The intramedullary placement of PFN at the intersection of the nail and lag screw opposes the bending force and permits early weight-bearing in unstable intertrochanteric femur by preventing lateral translation of the proximal piece.[9-11] However, PFN continues to be more expensive than DHS in comparison. The findings of the literature analysis indicate that PFN has no appreciable advantages over DHS in terms of problems and functional outcomes.[12,13] PFN has a number of advantages, but it also has a history of technological problems.[14,15] Patient mobilization takes longer with DHS than it does with PFN.

To evaluate the outcomes of treating these fractures using either of those two techniques — proximal femoral nailing or DHSs — we therefore performed a research.

MATERIALS AND METHODS

A prospective, randomized, and comparative research was carried out on patients referred to the Orthopaedics Department of Rohilkhand Medical College and Hospital, Bareilly, from November 2020 to November 2022 (24 months). A total of 100 patients older than 45 years of either sex were included in the study. In our research, we included all patients who met the criteria for anesthesia eligibility and who had intertrochanteric fracture type 31A2 (OTA categorization). The study's main goals were to assess the functional outcome in terms of fracture union, functional return, and complications in the two groups; to compare the DHS and PFN methods of fixation in intertrochanteric femur fracture with respect to intraoperative parameters (total duration of surgery, intraoperative blood loss, and intraoperative complication); and to identify the best implant for the fracture type to achieve the best outcome. The important CLINICAL tools of study were condition of wound, limb shortening and Harris hip score (HSS). The radiological tools used to reach the objectives were union of fracture post treatment, percentage of collapse, and associated complications.

After obtaining ethical clearance from the institutional ethics committee, the study was conducted among the study population after obtaining written informed consent. All patients provided the pertinent data, which included their medical histories and the results of their general and systemic exams.

A preliminary scan of the hip joint was taken in addition to the usual pre-anesthesia tests. A total of 100 individuals were split into two groups: 52 in the PFN group and 48 in the DHS group. Patients in Group A received proximal femur stapling treatment, while those in Group B received DHS treatment. Anteroposterior (AP) and side views of the post-operative X-ray are obtained [Figures 1-4]. Within 48 h, all drains were taken out on the 2nd and 5th days, the incisions were examined and stitches were taken out on 13th day. To monitor the union, degree of collapse, and any complications like screw cutting, patients were followed up at 6 months, 12 months, and 24 months [Figures 5-12].

Figure 1: Proximal femoral nail: Preoperative (AP and Oblique view left hip)

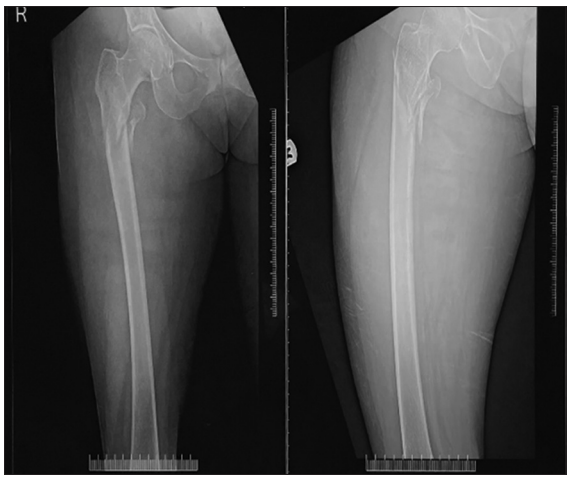

Figure 2: Proximal femoral nail: Preoperative (AP and oblique view right leg with hip)

Figure 3: Proximal femoral nail: Pre operative (AP view)

OBSERVATIONS AND RESULTS

In the DHS group, there were 48 (47.5%) patients, and in the PFN group, there were 52 (52.5%) patients [Table 1]. In the

DHS group, 7 (14.3%) patients were between the ages of 45 and 55, 33 (70.1%) were between the ages of 56 and 65, 6 (13.0%) were between the ages of 66 and 75, and 2 (2.6%) were over the age of 75. Eighteen (34.1%) patients in the PFN group were between the ages of 45 and 55, 26 (49.4%) were between the ages of 56 and 65, and 8 (16.5%) were between the ages of 66 and 75. The majority of the study's participants were between the ages of 56 and 65 [Table 2]. Twenty-five (50.6%) female patients and 23 (49.4%) male patients made up the DHS cohort. In the PFN group, there were 27 (52.9%) female patients and 25 (47.1%) male patients. There were more women in both categories than men [Table 3].

In the DHS group, 27 (44.2%) and 21 (55.8%) patients, respectively, suffered injuries as a result of road traffic incidents. In the PFN group, 24 (47.1%) and 28(52.9%) patients, respectively, suffered injuries as a result of road traffic incidents. The majority of patients in both categories suffered injuries as a result of falls [Table 4]. Twenty-four patients (50%) with left-sided involvement and 24 patients (50%) with right-sided involvement made up the DHS group. In the PFN group, 24 (48.1%) and 28 (51.8%) individuals had right- and left-sided involvement, respectively [Table 5]. The majority of the patients in both categories experienced involvement on the left side. Seven (15.6%) patients in the DHS group had outstanding results, 29 (59.7%) had good results, and 12 (24.7%) had acceptable results. Thirty-two (61.2%) patients in the PFN group had good outcomes, 15 (28.2%) patients had outstanding outcomes, and 5 (10.6%) patients had average outcomes [Table 6]. The bulk of the patients in both categories had satisfactory to exceptional final results. In the DHS cohort, equitable outcomes were more common.

Figure 4: Dynamic hip screw: Pre operative (AP pelvis with hip joint)

Forty-one (84.4%) of the individuals in the DHS group experienced no problems. Two (3.9%) patients had surface infection, 3 (6.5%) had shortening, and 2 (5.2%) had DVT. Forty-six individuals (88.2%) in the PFN group experienced no problems [Table 7]. Lag screw cutting was present in 3 (4.7%) patients, shortening was present in 1, and surface infection was present in 2 (4.7%) patients. The mean operating duration was 110± 14.4 min for the DHS group and 94 ± 7.06 min for the PFN group. The difference was determined to be statistically significant ($P = 0.001$) and revealed that the DHS group's operating time was considerably longer than the PFN group [Table 8]. In the DHS group, the average number of radioactive discharges [Table 9] was 84 ± 13.6, while in the PFN group, it was 89 ± 6.8. The difference was determined to be statistically insignificant ($P = 0.072$), demonstrating that the two groups had a similar average number of radiation shots.

In the DHS group, the mean inpatient stay was 5.6 ± 1.4 days, while in the PFN group, it was 4.6 ± 0.4 days. A considerably prolonged hospital stay in the DHS group compared to the PFN group was found to be statistically significant ($P = 0.001$) [Table 10]. In the DHS group, it took an average of 6.8 ± 0.6 weeks to reach complete weight bearing; in the PFN group, it took an average of 5.9 ± 0.7 weeks. There is a statistically significant difference between the two groups ($P = 0.001$), with the DHS group demonstrating a considerably lengthier time to complete weight-bearing than the PFN group [Table 11]. In the DHS group, the mean union duration was 12.6 ± 1.0 weeks, while in the PFN group, it was 11.8 ± 0.9 weeks. The difference was determined to be statistically significant ($P = 0.001$), demonstrating that the DHS group required considerably more time to unionize than the PFN group [Table 12].

At 6 months, the mean HHS in the PFN group was 65.2 ± 3.0 and 62.3 ± 3.0 in the DHS group. The difference was determined to be statistically significant ($P = 0.001$), indicating that the PFN group had improved HHS more at 6 months than the DHS group. The mean HHS at 12 months was 75.3 ± 2.9 in the DHS group and 77.0 ± 3.8 in the PFN group. The difference, which was determined to be statistically significant ($P = 0.001$), indicated

Figure 5: Proximal femoral nail: Post-operative

Figure 6: Proximal femoral nail: 6-month follow-up

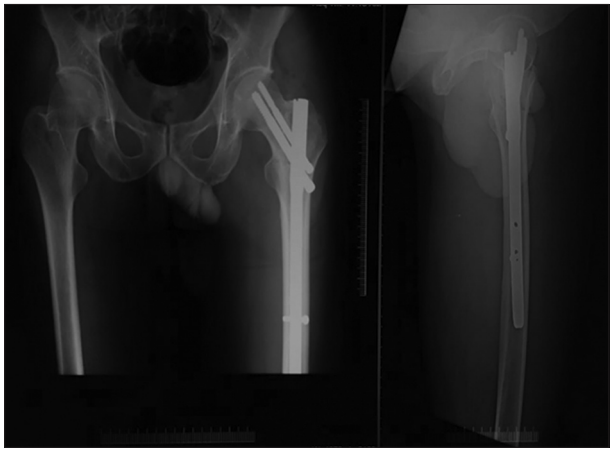

Figure 7: Proximal femoral nail: 12-month follow-up

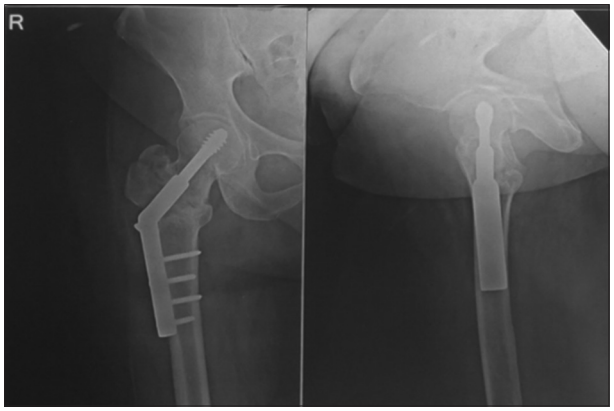

Figure 8: Dynamic hip screw: Post-operative

that the PFN group had improved HHS more over the course of a year than the DHS group had. At 24 months, the mean HHS in the PFN group was 86.3 ± 3.0 and 82.2 ± 3.8 in the DHS group [Table 13]. The difference, which was determined to be statistically significant ($P = 0.001$), indicated that the PFN group had improved HHS more over the course of 24 months than the DHS group had. The mean HHS was noticeably higher in the PFN group than the DHS group at each of the three follow-ups.

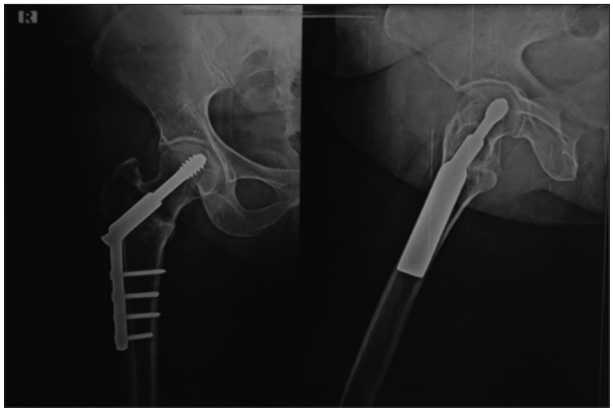

Figure 9: Dynamic hip screw: 6-month follow-up

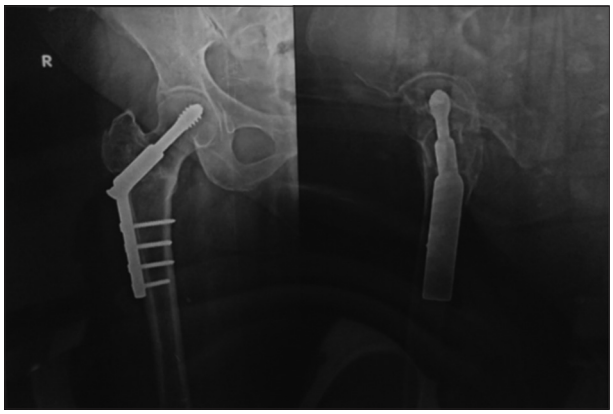

Figure 10: Dynamic hip screw: 12-month follow-up

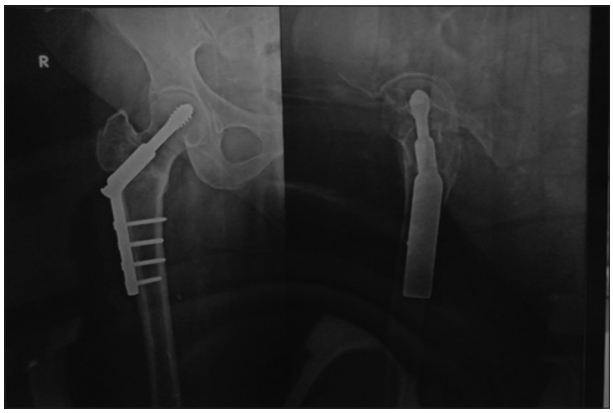

Figure 11: Dynamic hip screw: 24-month follow-up

DISCUSSION

Numerous studies have compared the results of treating intertrochanteric fractures with DHS versus PFN. To determine which treatment is superior in terms of patient compliance and long-term healing, it was important to compare the results of DHS and proximal femur nail operations in this research. The treatment of unstable fractures underwent a change during the 1960s DHS development. This treatment was frequently contraindicated in the aged with comorbidities due to the significant surgical dissection, blood loss, and surgery time needed.

Figure 12: Screw cut out

Table 1: Patient distribution

Group	*n* (%)
Dynamic hip screw	48 (47.5)
Proximal femoral nails	52 (52.2)
Total	100 (100)

Table 2: Patient distribution according to age in relation to groups

Age (years)	DHS group, *n* (%)	PFN group, *n* (%)
45–55	7 (14.3)	18 (34.1)
56–65	33 (70.1)	26 (49.4)
66–75	6 (13.0)	8 (16.5)
>75	2 (2.6)	0
Total	48 (100)	52 (100)

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 3: Patient distribution according to sex in relation to groups

Sex	DHS group, *n* (%)	PFN group, *n* (%)
Female	25 (50.6)	27 (52.9)
Male	23 (49.4)	25 (47.1)
Total	48 (100)	52 (100)

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 4: Patient distribution according to injury mode in relation to groups

Injury mode	DHS group, *n* (%)	PFN group, *n* (%)
Fall	27 (55.8)	28 (52.9)
RTA	21 (44.2)	24 (47.1)
Total	48 (100)	52 (100)

DHS: Dynamic hip screw, PFN: Proximal femoral nail

PFN, which was created in the early 1990s with physical benefits over DHS, has grown in popularity. The majority of the participants in our research were between the ages of 56 and 65.

In our research, 25 patients in the DHS group and 27 patients in the PFN group were female, while 23 patients in the DHS

Table 5: Patient distribution according to injury side in relation to groups

Injury side	DHS group, *n* (%)	PFN group, *n* (%)
Left side	24 (49.4)	28 (51.8)
Right side	24 (50.6)	24 (48.2)
Total	48 (100)	52 (100)

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 6: Patient distribution according to final outcome

Final outcome	DHS group, *n* (%)	PFN group, *n* (%)
Excellent	07 (15.6)	15 (28.2)
Good	29 (59.7)	32 (61.2)
Fair	12 (24.7)	9 (10.6)
Total	48 (100)	52 (100)

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 7: Patient distribution according to complications

Complication	DHS group, *n* (%)	PFN group, *n* (%)
None	41 (84.4)	46 (88.2)
Deep venous thrombosis	02 (5.2)	0
Lag screw cutout	0	03 (5.7)
Limb shortening	03 (6.5)	01 (1.4)
Superficial infection	02 (3.9)	02 (4.7)
Total	100 (100)	100 (100)

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 8: Operative time comparison

Group	Time, mean±SD	*P*
DHS group	110±14.4	0.001
PFN group	94±7.06	0.001

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 9: Number of radiation shoots comparison

Group	Radiation shoots, mean±SD	P
DHS group	84±13.6	0.062
PFN group	89±6.8	0.062

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 10: Mean hospital stay comparison

Group	Hospital stay, mean±SD	*P*
DHS group	5.6±1.4	0.001
PFN group	4.6±0.4	0.001

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 11: Mean duration to full weight bearing comparison

Group	Time, mean±SD	*P*
DHS group	6.8±0.6	0.001
PFN group	5.9±0.07	0.001

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 12: Mean union time comparison

Group	Union time, mean±SD	*P*
DHS group	12.6±1.0	0.001
PFN group	11.8±0.90	0.001

DHS: Dynamic hip screw, PFN: Proximal femoral nail

Table 13: Mean Harris hip score comparison

Parameter	Group	Union time, mean±SD	*P*
HHS at 6 months	DHS group	62.3±2.0	0.001
	PFN group	65.2±3.0	
HHS at 12 months	DHS group	75.3±2.9	0.001
	PFN group	77.0±3.8	
HHS at 24 months	DHS group	82.2±3.8	0.001
	PFN group	86.3±3.0	

DHS: Dynamic hip screw, PFN: Proximal femoral nail

group and 25 patients in the PFN group were male. There was a significant female predominance in both categories. In addition to these results, the research by Jonnes *et al.* revealed that males are more susceptible to IT fractures, with 16 of the 30 cases (or 53%) being male and 14 (or 47%) female.[3] On the other hand, according to Mundla *et al.*[16], out of 60 instances, 27 patients (45%) and 33 patients (55%) were female and masculine, respectively. Males are less impacted than females are. According to Harrington and Johnston, Poigenfürst and Schnabl, Laskin and Gruber, Jonnes *et al.*[3,17–20], there is a predominance of female sex.

In the DHS group, 21 (44.2%) and 27 (55.8%) patients, respectively, suffered injuries as a result of road traffic incidents and fall. In the PFN group, 24 (47.1%) and 28 (52.9%) patients, respectively, suffered injuries as a result of road traffic incidents and fall. The majority of patients in both categories suffered injuries as a result of falls. In addition, Mundla *et al.*[21] discovered that slide and fall injuries accounted for 70% of all IT injuries, with traffic mishaps accounting for the remaining 23.3%. Patients who had been hurt by a stumble and fall were older than those who had been hurt by renal tubular acidosis.

Twenty-four patients (49.4%) in the DHS group in the current research had involvement on the left side, and 24 patients (50.6%) had involvement on the right side. In the PFN group, 24 (48.2%) and 28 (51.8%) individuals, respectively, had involvement on the right and left sides. The majority of the patients in both categories experienced involvement on the left side. In the current research, 41 (84.4%) of the DHS group's patients had no problems, compared to 2 (5.2%) DVT cases, 3 (6.5%) shortening cases, and 2 (3.9%) superficial infections. Forty-two (88.2%) patients in the PFN group experienced no problems, lag screw cutting occurred in 3, shortening occurred in 1, and superficial infection occurred in 2 (4.7%) patients. Complication incidence was slightly greater in the DHS group compared to the PFN group.

The mean operating duration was 110 ± 14.4 min for the DHS group and 94.0 ± 7.06 min for the PFN group. The difference was determined to be statistically significant ($P = 0.001$), indicating that the DHS group's operating time was considerably longer than the PFN group's. In a related research, Pan *et al.*[6] found that the average operation time for PFN was 59.16 min, which is less than the average time needed for DHS, which is 87.35 min. Compared to the percutaneous method of PFN, the DHS group needs a considerably longer time for wound closure, most likely because of a bigger incision and extensive dissection.

In the DHS group, the average number of radioactive discharges was 84 ± 13.6, while in the PFN group, it was 89 ± 6.8. The difference was determined to be statistically insignificant, demonstrating that the two groups had a similar average number of radiation discharges.

In the DHS group, the mean inpatient stay was 5.6 ± 1.4 days, while in the PFN group, it was 4.6 ±0.4 days. The difference was determined to be statistically significant ($P = 0.001$), indicating that the DHS group had a considerably lengthier hospital stay than the PFN group.

In the DHS group, the mean time to complete weight bearing was 6.8 ± 0.6 weeks, which was reached in 88 weeks. The difference was determined to be statistically significant ($P = 0.001$), indicating that the DHS group experienced a considerably lengthier time to reach full weight-bearing than the PFN group.

In the DHS group, the mean union duration was 12.6 ± 1.0 weeks, while in the PFN group, it was 11.8 ±0.9 weeks. The difference was determined to be statistically significant ($P = 0.001$), demonstrating that the DHS group required considerably more time to unionize than the PFN group.

At 6 months, the mean HHS in the PFN group was 65.2 ± 3.0 and 62.3 ± 2.0 in the DHS group. The difference was determined to be statistically significant ($P = 0.001$), indicating that the PFN group had improved HHS more at 6 months than the DHS group. The mean HHS at 12 months was 75.3 ± 2.9 in the DHS group and 77.0 ± 3.8 in the PFN group. The difference, which was determined to be statistically significant ($P = 0.001$), indicated that the PFN group had improved HHS more over the course of a year than the DHS group had. The mean HHS at 24 months was 86.3 ± 3.0 in the PFN group and 82.2 ± 3.8 in the DHS group. The difference, which was determined to be statistically significant ($P = 0.001$), indicated that the PFN group had improved HHS more over the course of 24 months than the DHS group had. The results of 30 instances of intertrochanteric fractures treated with DHS and PFN in a research by Jonnes *et al.* revealed similar results. Results revealed that patients who received PFN began ambulating earlier because their HHS at 3 months, 6 months, and 12 months was comparably improved. Similar findings were found in a research by Chaitanya *et al.*[21] comparing the outcomes of proximal femoral nailing versus DHS for intertrochanteric fractures. Out of 60 individuals with intertrochanteric fractures, 30 received intramedullary hip screws and 30 received sliding hip screws with plates as treatment. HHS did not reveal any appreciable changes in either group between the 1 month and 1 year periods. DHS and PFN HHSs were

identical for the 6-month and 1-year follow-up periods (94.2 for DHS, 94.6 for PFN). At 4 weeks to 1 year, PFN group had greater HHS than DHS group, but the difference was not statistically significant. Similar results were found in a study by Bhakat and Bandyopadhayay. In their research, the hip score at 1 month was lower in the DHS group (mean = 24.5) than in the PFN group (mean = 35.23), $P = 0.0001$, and the hip score at 6 months was also lower in DHS (mean = 78.8) than in PFN (mean = 82.8), $P = 0.021$. However, after a year of follow-up, this disparity vanished, leaving the two groups comparable (DHS - 92.1 and PFN - 92.57). Dr. Bakshi *et al.* research, where the mean HHS in the PFN group was 84.25 and in the DHS group was 83.45, found a comparable result. The findings of the present research were similar to those found in the literature. It was determined to be not statistically significant, demonstrating the nearly identical long-term outcomes of intramedullary and plate fixing. However, at 6 months, the majority of cases fall into the outstanding and good categories of PFN, whereas in DHS, the majority of cases fall into the good and middling categories of HHS.

CONCLUSION

Both DHS and the PFN are superior surgery stabilization techniques for intratrochanteric femur fractures. Both of these techniques produce results that are comparable in terms of intraoperative parameters (total surgery duration, detailed intraoperative research regarding intraoperative blood loss, and other intraoperative complication), as well as functional outcomes (union of the fracture, return to functional activity, morbidity, and implant failure); however, PFN holds an advantage over DHS in terms of lesser blood loss, operative time, early ambulation, and less incidence of comp. However, more research is advised for better results.

REFERENCES

1. Kumar R, Singh RN, Singh BN. Comparative prospective study of proximal femoral nail and dynamic hip screw in treatment of intertrochanteric fracture femur. J Clin Orthop Trauma 2012;3:28-36.
2. Hong JY, Suh SW, Park JH, Shin YS, Yoon JR, Yang JH. Comparison of soft-tissue serum markers in stable intertrochanteric fracture: Dynamic hip screw versus proximal femoral nail-a preliminary study. Injury 2011;42:204-8.
3. Jonnes C, Sm S, Najimudeen S. Type II Intertrochanteric fractures: Proximal femoral nailing (PFN) versus dynamic hip screw (DHS). Arch Bone Jt Surg 2016;4:23-8.
4. Bhakat U, Bandyopadhayay R. Comparitive study between proximal femoral nailing and Dynamic hip screw in intertrochanteric fracture of femur. Open J Orthop 2013;3:291-5.
5. Bakshi AS, Kumar P, Brar BS. Comparative study between DHS and PFN in intertrochanteric fractures of femur. Int J Orthop Sci 2018;4:259-62.
6. Pan XH, Xiao DM, Lin BW. Dynamic hip screws (DHS) and proximal femoral nails (PFN) in treatment of intertrochanteric fractures of femur in elderly patients. Chin J Orthop Trauma 2004;7:785-9.
7. Bridle SH, Patel AD, Bircher M, Calvert PT. Fixation of intertrochanteric fractures of the femur. A randomised prospective comparison of the gamma nail and the dynamic hip screw. J Bone Joint Surg Br 1991;73:330-4.
8. Khan IA. O1013 to nail or to screw? J Bone Joint Surg Br 2004;86:225-6.
9. Valverde JA, Alonso MG, Porro JG, Rueda D, Larrauri PM, Soler JJ. Use of the Gamma nail in the treatment of fractures of the proximal femur. Clin Orthop Relat Res 1998:350:56-61.
10. Pavelka T, Matejka J, Cervenková H. Complications of internal fixation by a short proximal femoral nail. Acta Chir Orthop Traumatol Cech 2005;72:344-54.
11. Suckel AA, Dietz K, Wuelker N, Helwig P. Evaluation of complications of three different types of proximal extra-articular femur fractures: Differences in complications, age, sex and surviving rates. Int Orthop 2007;31:689-95.
12. Reindl R, Harvey EJ, Berry GK, Rahme E, Canadian Orthopaedic Trauma Society (COTS). Intramedullary versus extramedullary fixation for unstable intertrochanteric fractures: A prospective randomized controlled trial. J Bone Joint Surg Am 2015;97:1905-12.
13. Siddiqui YS, Khan AQ, Asif N, Khan MJ, A Sherwani MK. Modes of failure of proximal femoral nail (PFN) in unstable trochanteric fractures. MOJ Orthop Rheumatol 2019;11:7-16.
14. Bienkowski P, Reindl R, Berry GK, Iakoub E, Harvey EJ. A new intramedullary nail device for the treatment of intertrochanteric hip fractures: Perioperative experience. J Trauma 2006;61:1458-62.
15. Boldin C, Seibert FJ, Fankhauser F, Peicha G, Grechenig W, Szyszkowitz R. The proximal femoral nail (PFN)-a minimal invasive treatment of unstable proximal femoral fractures: A prospective study of 55 patients with a follow-up of 15 months. Acta Orthop Scand 2003;74:53-8.
16. Mundla MK, Shaik MR, Buchupalli SR, Chandranna B. A prospective comparative study between proximal femoral nail and dynamic hip screw treatment in trochanteric fractures of femur. Int J Res Orthop 2018;4:58-64.
17. Harrington KD, Johnston JO. The management of comminuted unstable intertrochanteric fractures. J Bone Joint Surg Am 1973;55:1367-76.
18. Shen HM, Liang CW, Fan YQ. The clinical study of the treatment of intertrochanteric fractures in the elderly with DHS, Gamma nail and PFN. Chin J Clin Med 2007;2:226-8.
19. Poigenfürst J, Schnabl P. Multiple intramedullary nailing of pertrochanteric fractures with elastic nails: Operative procedure and results. Injury 1977;9:102-13.
20. Laskin RS, Gruber MA, Zimmerman AJ. Intertrochanteric fractures of the Hip in the elderly. Clin Orthop 1979;101:110-9.
21. Chaitanya M, Mittal A, Rallapalli R, Biju R, Prasad YS. Comparision of dynamic hip screw and plate with proximal femoral nail in trochanteric fractures of femur. J Dent Med Sci 2015;14:73-82.